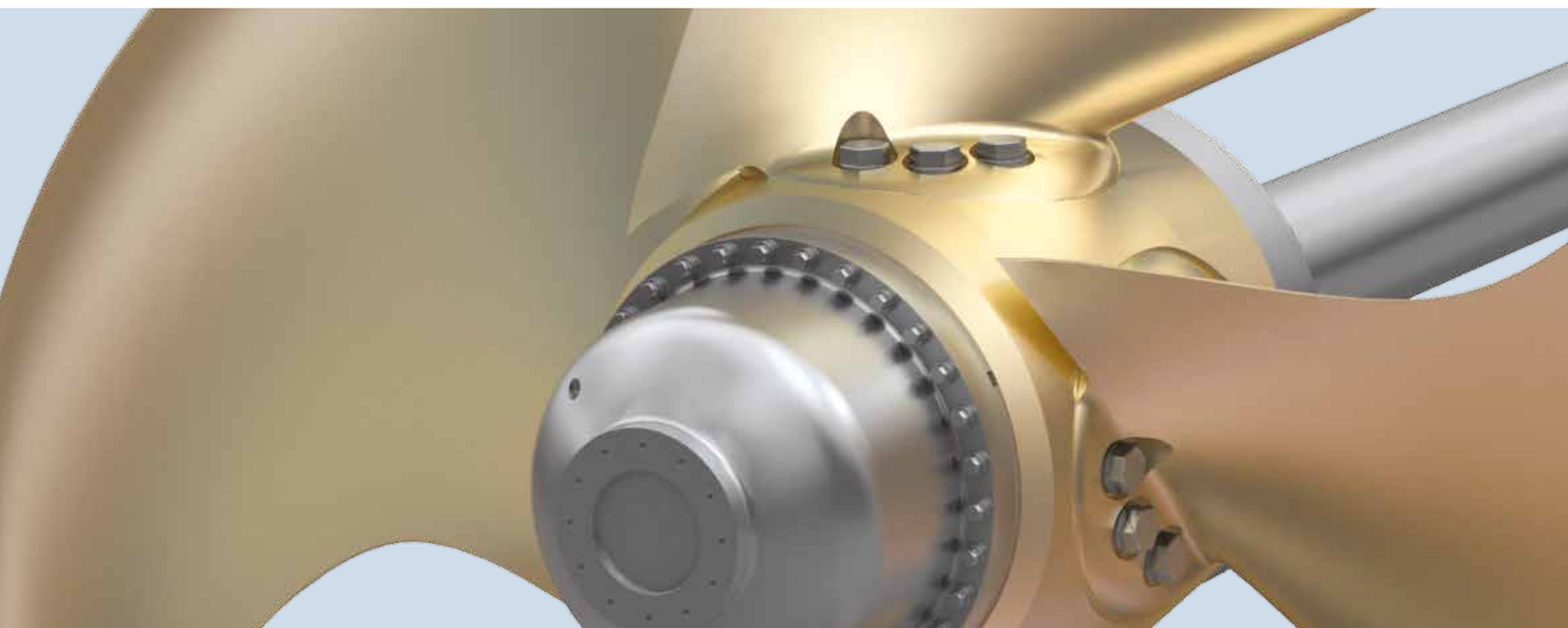
Rolls-Royce

Propulsion

Moving your business in the right direction



Propulsion systems for optimal operations under all conditions

Rolls-Royce is the leading developer and supplier of propulsion equipment. A supplier who has the capability to meet your demands regarding performance and cost-effectiveness. And with a truly international presence Rolls-Royce provides service and maintenance worldwide.

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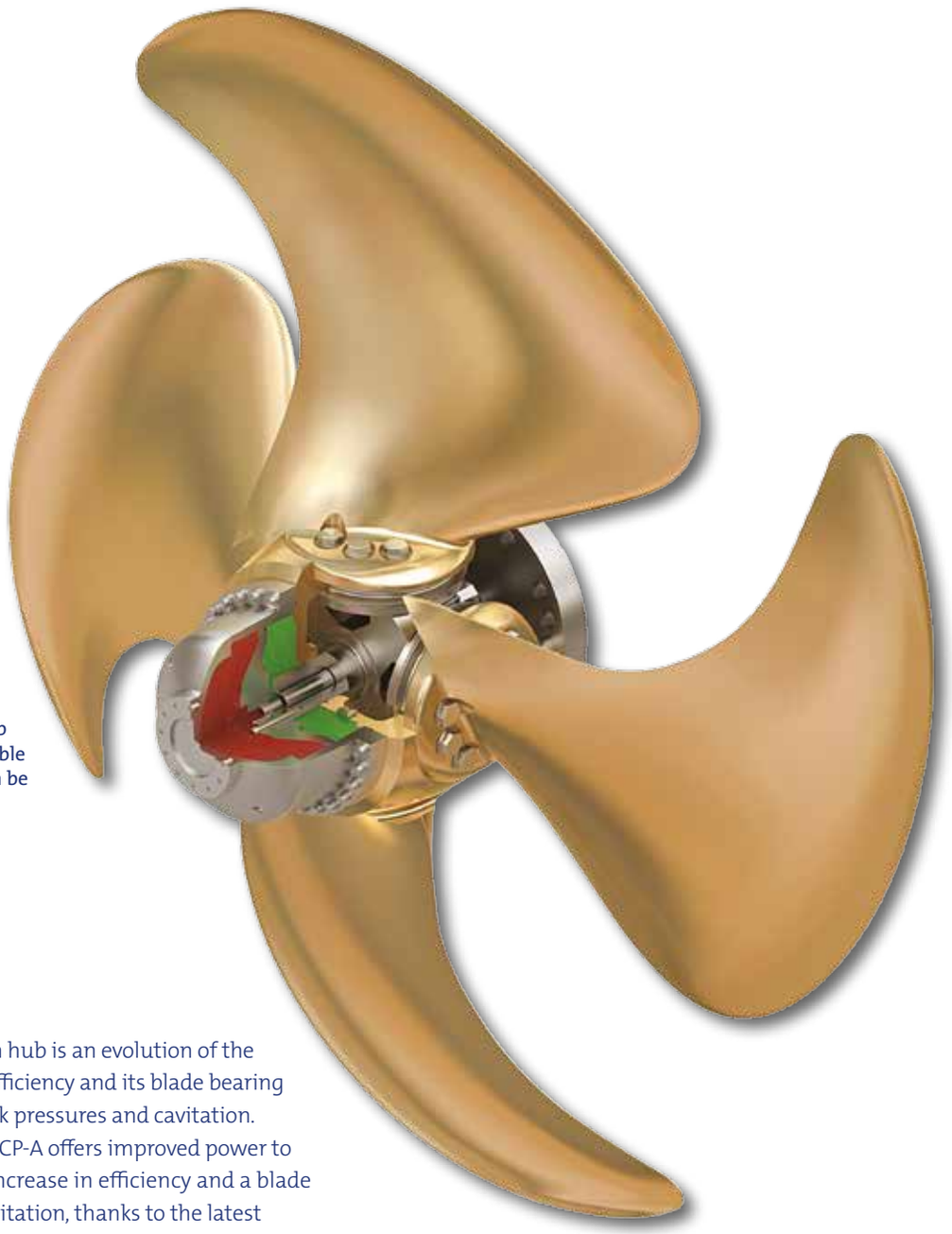
control the power

Controllable pitch propellers



Bronze or stainless steel blades and hub can be specified, and a version is available in which the blades and blade seals can be exchanged under water.

The Kamewa CP-A controllable pitch hub is an evolution of the XF5 system, renowned for its high efficiency and its blade bearing arrangement designed to avoid peak pressures and cavitation. Compared with its predecessor, the CP-A offers improved power to weight ratio by 20%, a significant increase in efficiency and a blade foot with decreased exposure to cavitation, thanks to the latest mechanical design and hydrodynamic techniques.

At the same time, the blade foot bearing surfaces have been increased to provide even greater strength and wear-resistance. The system can be supplied with four or five blades of high skew or moderate skew type, conventional or nozzle design.

Key product benefits

- Two main hub types are available; standard for speeds below 30 knots and H for speeds above 30 knots
- The range of hub sizes will cover powers from approx. 0.5 to 75 MW
- The CP-A hub offers normal pitch control and can also be supplied with full blade feathering
- Open water, nozzle, and ice-class options
- Full US Mil-Spec shock versions are available

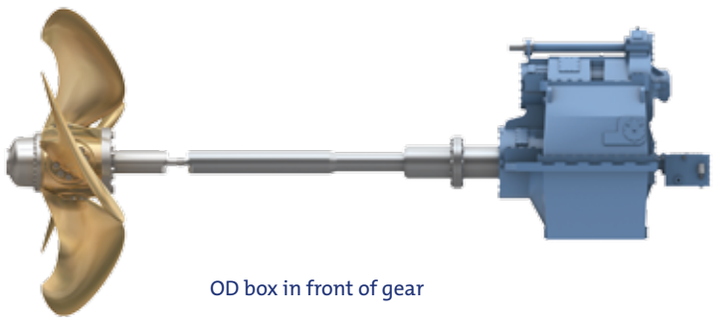
Typical applications:

- Fast ferries
- Cruise ships
- Container ships
- Cargo vessels
- Tankers
- Naval vessels
- Offshore support vessels
- Fishing vessels
- Seismic vessels
- Coastguard

The CP-A is available with three types of oil distribution systems; D-F, I and D-M.

Type D-F:

The oil distribution box is mounted on the forward end of the reduction gearbox. Additional intermediate shafts can be arranged between the propeller shaft and the gearbox.



OD box in front of gear

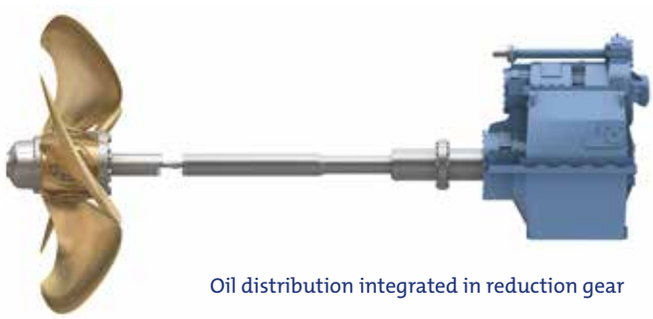
Type D-M:

A separate shaft carries the oil distribution box, and additional intermediate shafts can be arranged between the propeller shaft and the OD box shaft.

OD box in shaftline

Type I:

Oil distribution integrated in reduction gearbox. The reduction gearbox is a free-standing gearbox intended for integrated propulsion systems.



Oil distribution integrated in reduction gear

Reduction gears

The Rolls-Royce reduction gear range is of the proven single-input single-output design with built-in clutch and thrust block. They have a variety of power take-offs that enable large shaft generators to be driven, and electric motors to feed in power for get-you-home propulsion or as part of a hybrid system. Power, torque and shaft offsets correspond to current and anticipated market demands in terms of engine power/speed and propeller revolutions for a wide range of vessels. Large reduction ratios allow for all popular medium speed engines with ratio reduction up to 6.25:1.

The AGHC type has a max. torque output from 90 to 950 kNm. It is available with a range of both vertical and horizontal shaft offsets. Four configurations can be specified; Standard AGHC, P – with primary PTI/PT, S – with secondary PTO and SC – with secondary PTO and clutch.

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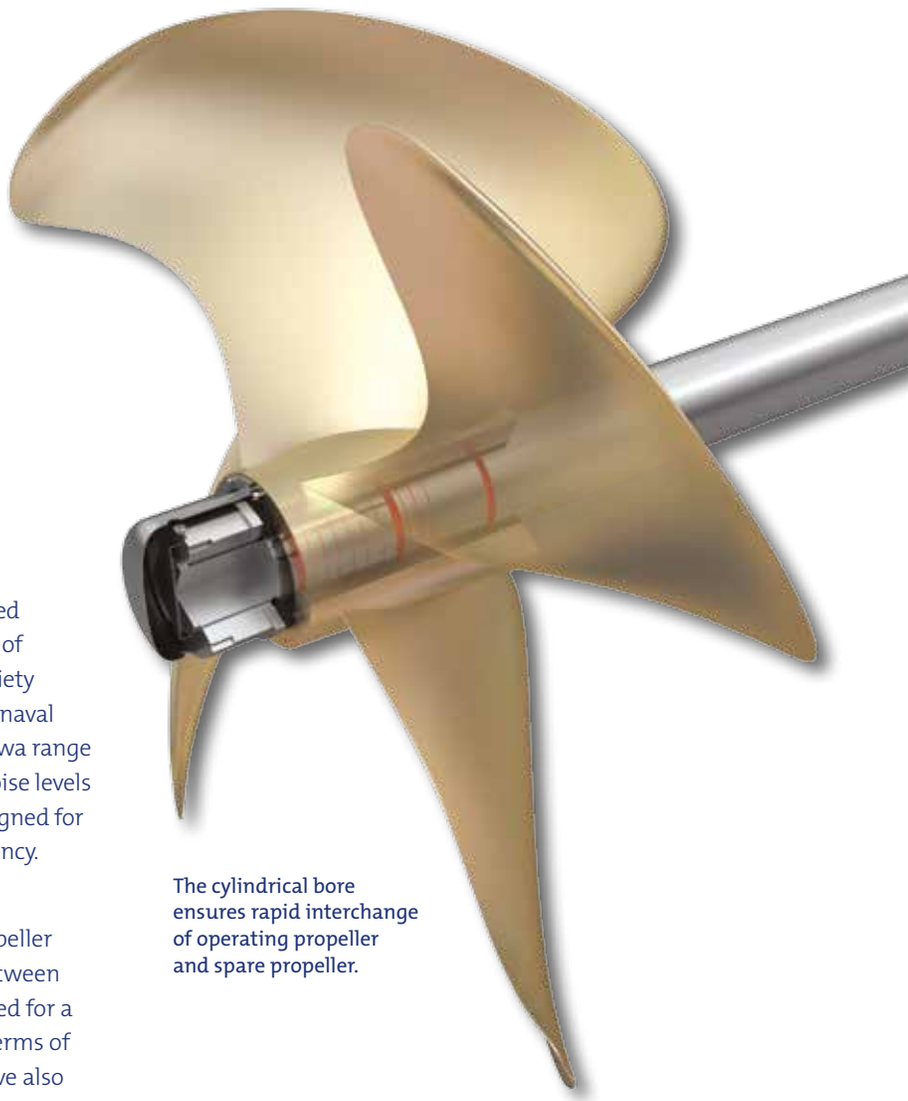
1. Standard AGHC vertical offset reduction gear.

2. Horizontal offset AGHC-s/SCP with secondary PTO.

3. Vertical offset AGHC-s/SC with secondary PTO.

Fixed pitch propellers



The cylindrical bore ensures rapid interchange of operating propeller and spare propeller.

Rolls-Royce has many years of experience in the design of fixed pitch propellers. In the US we have our own foundry capable of producing fixed pitch propellers up to 10m diameter in a variety of materials, to the exacting tolerances required for modern naval platforms. The characteristics of the Bird-Johnson and Kamewa range of FP propellers provide good fuel economy, low vibration/noise levels and no harmful cavitation. They are usually individually designed for the specific vessel, to deliver the optimum in propeller efficiency.

The SKF propeller sleeve

This propeller sleeve is a unique concept that simplifies propeller removal and mounting, provides full inter-changeability between operating propeller and spare propeller, and reduces the need for a spare propeller shaft. It offers considerable cost savings in terms of downtime, maintenance and repairs. The SKF propeller sleeve also generates major savings by speeding up the installation process, eliminating match marking or gauges. The FPP is designed with either a taper shaft or SKF sleeve.

Rolls-Royce offers a complete FPP package

- Individual design
- Monoblock propellers of moderate or high-skew designs for both open and nozzle applications
- Shafting with stern tube, bearings, sealings, nozzle, etc.
- The SKF Propeller Sleeve
- Shaft calculations, such as whirling and alignment
- Performance guarantees

New Generation Workwheels

Part of the Rolls-Royce product portfolio – New Generation Workwheels – are available in five standard propeller designs specifically suited for workboats and manufactured in manganese bronze, NiAl-bronze and stainless steel. Designed to outperform conventional three and four-bladed designs, New Generation Workwheels apply state-of-the-art technology routinely used in the design of large commercial and naval propellers. The improved performance is a result of the application of latest hydrodynamic design codes, which are applied in both design and off design operating conditions.

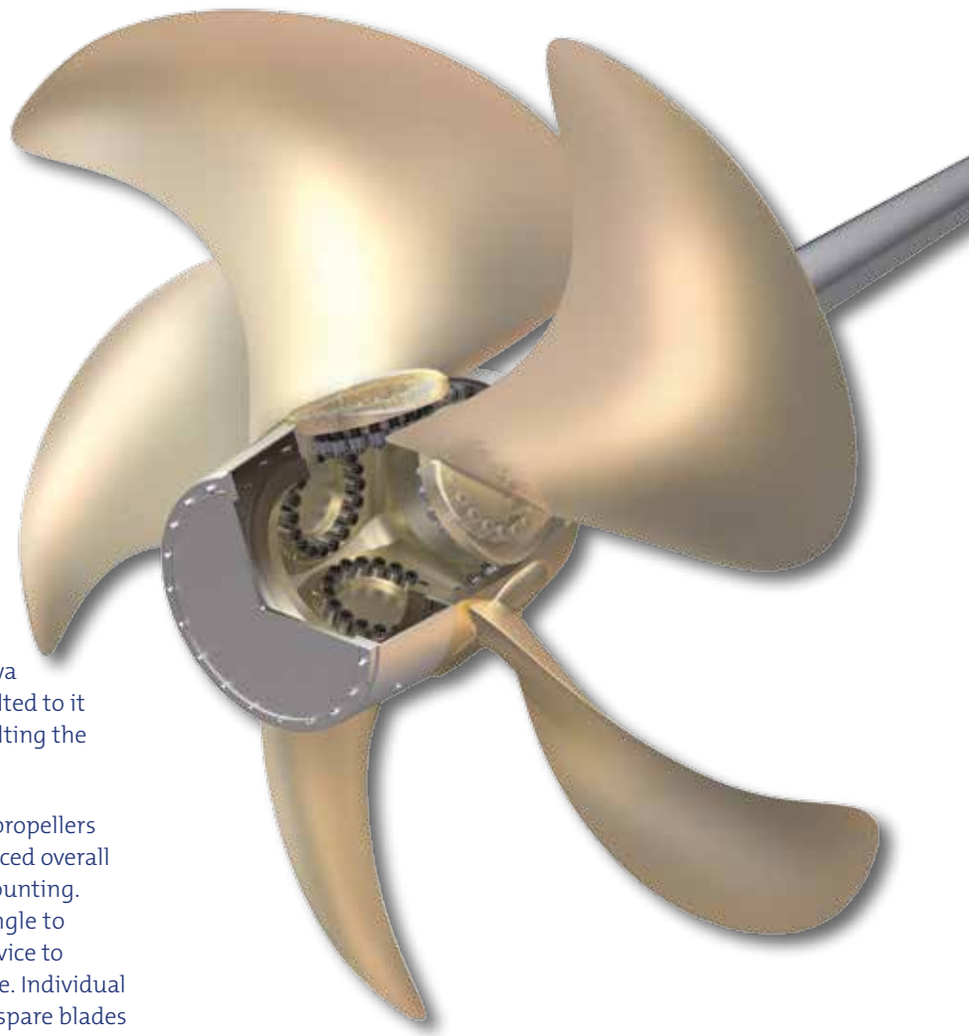
Key product benefits

- Five blades
- Optimised variable pitch distribution
- Non-linear blade skew of 18 degrees
- Advanced new technology blade sections
- Close to 50% reduction in ship hull vibrations due to propeller induced hull pressures
- About 50% reduction in ship machinery vibration levels due to propeller induced unsteady shaft forces
- Improved propeller efficiency

Typical applications:

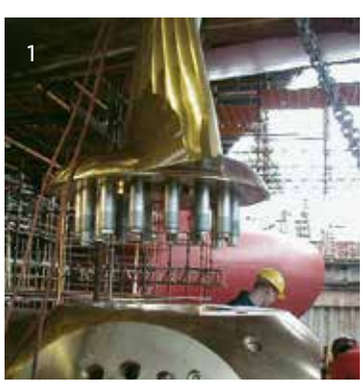
- Tankers
- Cargo vessels
- Cruise ships
- Ferries
- Arctic vessels
- Various types of naval vessels

Adjustable bolted propellers



The adjustable bolted propeller allows the most efficient blade matching for optimum efficiency, while simplifying the installation process. The Kamewa range of ABP is based on a hollow hub with blades bolted to it from the inside. A unique feature is the method of bolting the blades to the hub using simple hand tools.

In comparison to conventional monobloc fixed pitch propellers the ABP has higher quality blade machining and reduced overall weight, which give easier shipment, handling and mounting. The slotted holes on the hub allow the blade pitch angle to be conveniently adjusted at commissioning, or in service to compensate for long-term variations in hull resistance. Individual blades can be replaced without drydocking, and only spare blades have to be stocked rather than a complete monobloc propeller.



1. The ABP offers fast and simple installation compared to a monobloc unit.

2. The hollow hub reduces total weight and extends bearing life.

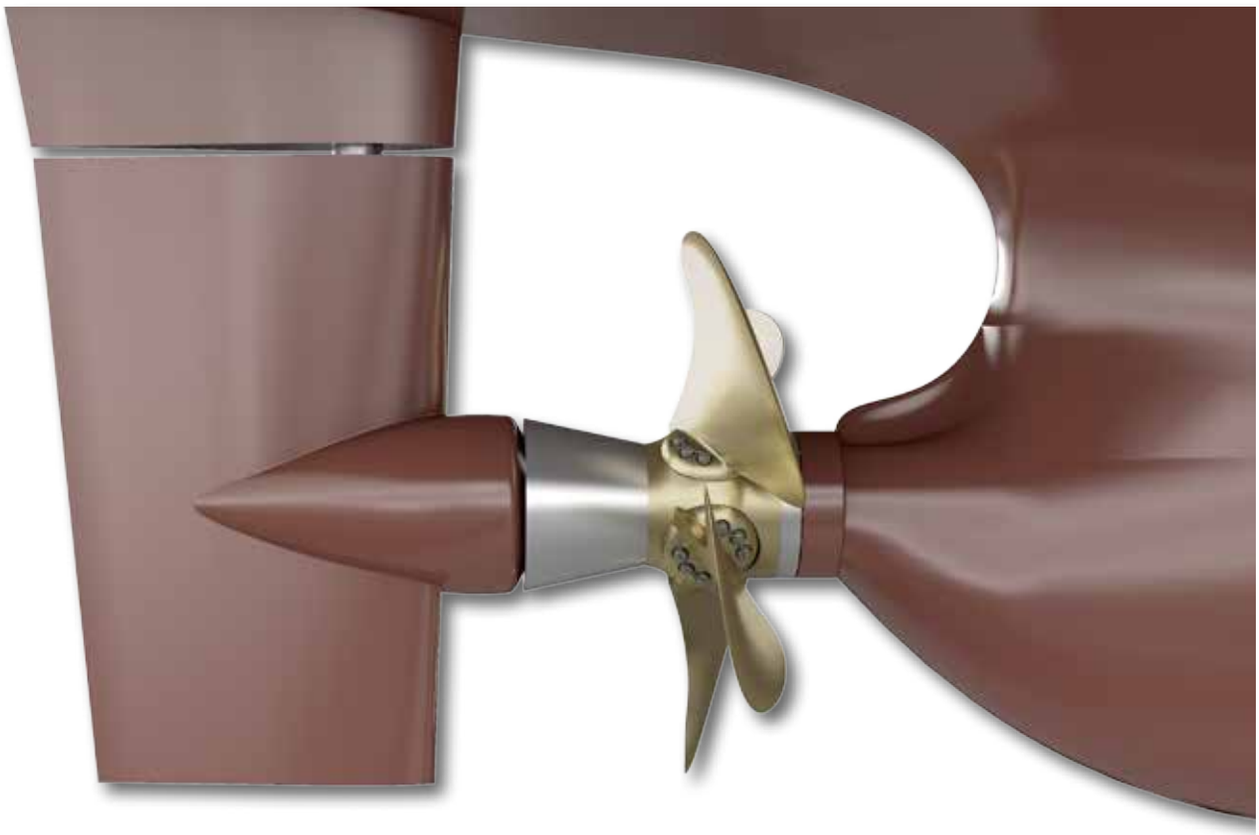
Typical applications:

- Cruise vessels
- Tankers
- Cargo/container vessels
- Various types of naval vessels

Key product benefits

- Spare propeller not needed, thus short pay-off compared to FPP
- Slotted holes on the hub allow stepless blade pitch angle adjustment
- Stainless steel or NiAl-bronze blades
- 4,5 or 6 blades available
- Simpler, less costly installation at the shipyard. Match marking not needed
- Smaller, lighter components mean lower costs for shipment, storage and handling
- Individual blades can be replaced if damaged
- Easy underwater installation and replacement of blades
- Hollow hub reduces total weight and extends bearing life
- Higher accuracy than a monobloc propeller since individual parts are machined more efficiently
- No limitation in size or weight

Integrated propulsion and manoeuvring system



The best in propulsion and manoeuvring

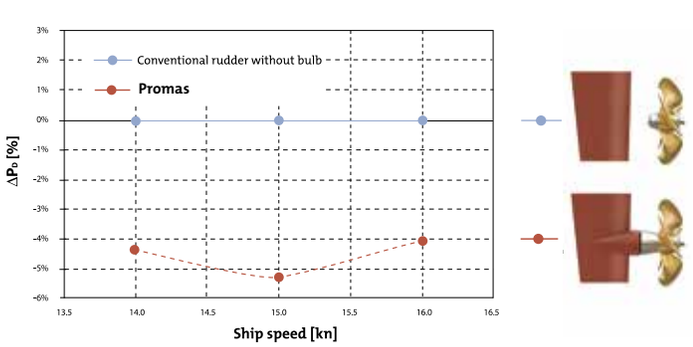
Promas integrates the propeller and the rudder into a single system to optimise hydrodynamic efficiency. A special hubcap is fitted to the propeller which streamlines the flow onto a bulb that is added to the rudder, effectively reducing flow separation immediately after the propeller. The result is an increase in propeller thrust as previously wasted energy is recovered from the flow. The addition of the bulb on the rudder also streamlines the flow aft of the rudder, further reducing drag.

A twisted rudder provides further improvements in efficiency and manoeuvrability.

Improved propulsive efficiency

In general the efficiency gain is between 3-8% for single screw vessels and 2-6% for twin screw vessels. Virtually any vessel will benefit. The position of the rudder in the slipstream and the skeg design can deliver further improvements. Designs are extensively tested and verified in the Rolls-Royce Hydrodynamic Research Centre. Promas is available together with all Rolls-Royce propellers (type ABP, FP and CP) and with spade and flap rudders.

Comparison tests with conventional propeller/rudder systems are shown in the graph below.



- Single screw - Chemical tanker
- Efficiency improvement by RR rudder 4.0 - 5.1%

Key product benefits

- Reduced fuel consumption
- Reduced environmental impact
- Short payback period
- Increased propulsive efficiency
- Simple installation
- Improved manoeuvrability

Typical applications:

- Ferries
- Cruise ships
- Fishing vessels
- Car carriers
- Cargo carriers
- Bulkers
- Tankers
- Platform supply vessels

Integrated propulsion and manoeuvring system

Promas with nozzle

For efficient high bollard pull applications

A natural evolution of the successful Promas, this system unites a new type of nozzle with an optimised propeller, hubcap, rudder bulb and a special rudder profile developed to provide very high steering forces yet minimise drag. It meets the requirements for large pulling power at low speed with a high free-running speed in transit. Components are designed to work together in a ducted system, maximising efficiency and minimising disturbances in the water flow both through and around the nozzle. Developed through CFD testing and analysis, the nozzle is a major advance on the profile used in conventional nozzle propeller installations. In a typical anchorhandler propulsion system it will reduce fuel consumption in transit by 15% or more, and improve bollard pull by around 5%.

Depending on the exact requirements the rudder may be either a one-piece design or a medium flap type.

Promas Lite

Improving propulsive efficiency is the key in reducing fuel burn, and this simple modification allows vessels already in service to benefit from Promas efficiency gains. There are three areas of modification – welding a prefabricated bulb to the existing rudder, bolting a hubcap to the propeller, and fitting a new propeller or reblading the original. Installation is normally 7-10 days and the payback time can be under two years.

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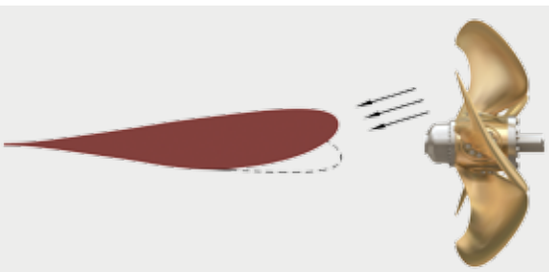


1. The leading edge of the twisted rudder is adapted according to the inflow angle from the propeller slipstream.

2. Rudders of a special profile have been developed into the Promas with nozzle concept to provide high steering side forces with minimum drag, either of a one piece or medium flap-type design.

3. The Promas Lite modification allows vessels already in service to benefit from Promas efficiency gains.

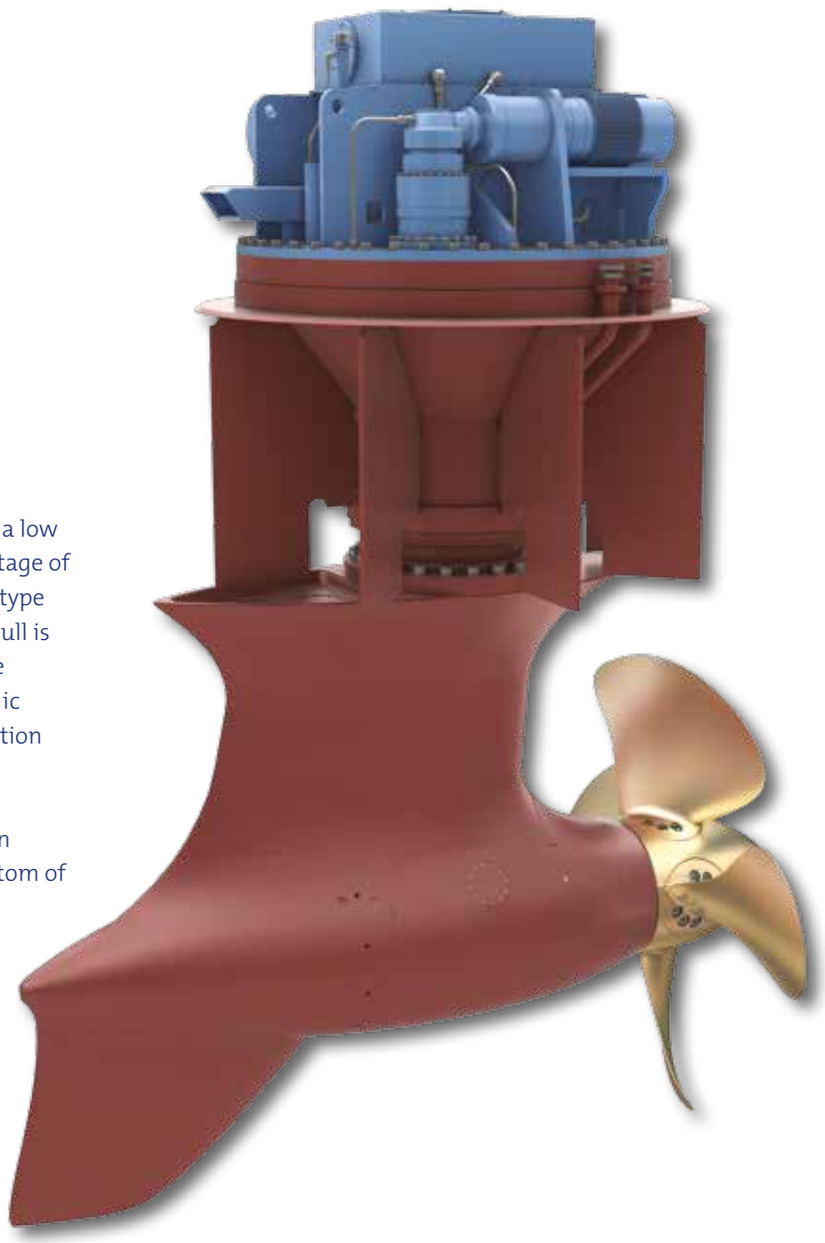
2

3

Typical applications:

- Anchorhandling offshore vessels
- Seismic survey
- Tugs
- Fishing vessels
- Multipurpose platform supply vessels
- Offshore construction vessels
- Cargo vessels

Azimuthing pulling propeller



The Rolls-Royce azimuthing pulling propeller, type Azipull, is a low drag, highly efficient pulling thruster. It combines the advantage of the pulling propeller with the flexibility of using almost any type of drive to suit the customer's specific requirement. The Azipull is designed for continuous service speed up to 24 knots, while maintaining excellent manoeuvrability. High hydrodynamic efficiency, fuel efficiency, course stability, low noise and vibration levels are other key characteristics of the Azipull.

Internally, it has a purely mechanical drive system based on well-proven technology using bevel gears at the top and bottom of the leg. Power is fed to the unit through a horizontal input shaft within the hull, and the unit incorporates its own steering motors for azimuthing.

The Azipull combines the advantages of an azimuthing thruster offering high manoeuvrability, and a low drag, highly efficient propulsor, enabling high speeds. The flexibility of the unit is also enhanced by the fact that it is available in both CP and FP versions. The Azipull is delivered with remote control systems.

Typical applications:

- Offshore supply/service vessels
- Offshore stand-by vessels
- Coastal ferries
- Cargo vessels
- Naval vessels

The streamlined leg and skeg recover swirl energy from the slipstream, raising the overall propulsive efficiency. The leg has a wide chord to optimise rudder effect and improve the vessel's course stability.

Technical data	AZP085	AZP100	AZP120	AZP150
Propeller diameter (mm)	1900 - 2300	2300 - 2800	2800 - 3300	3300 - 4200
Power (max cont.rating)	900 - 1600	1400 - 2500	1800 - 3500	3000 - 5000
Nominal input speed (rpm)	1200 - 2000	720 - 1800	720 - 1200	600 - 1000
Dry weight (kg)	13 tonnes	31 tonnes	45 tonnes	85 tonnes

All data subject to change without prior notice.

Azimuth thrusters

Rolls-Royce is one of the world's leading suppliers of azimuth thrusters. The basic idea behind an azimuth thruster is that the propeller can be rotated 360 degrees around the vertical axis, providing omni-directional thrust. The Rolls-Royce range of azimuth thrusters therefore offer superior manoeuvrability. The simple and robust construction provides high operational reliability along with easy maintenance, which result in a best possible total economy.

The flexibility in design makes the azimuth thrusters ideal to a wide range of vessels. The low noise and vibration levels further enhance the area of use. The Rolls-Royce thrusters can be delivered for diesel or electric drive. The units are available as open or ducted with fixed or controllable pitch, or with contra-rotating propellers. The azimuthing thrusters are delivered with remote control systems.

Arctic operations

Rolls-Royce has a long history of delivering azimuth thrusters for vessels operating in icy conditions. These vessels range from tugs and road ferries to icebreakers, with classifications from Baltic ice classes to high Arctic icebreaker ice classifications. The applications require project specific tailoring for the best possible azimuth thruster solution.

Key product benefits

- Open or ducted options, with fixed pitch, controllable pitch and contra-rotating propellers
- Reduction ratios optimised for the application
- Diesel or electric drive
- Rugged design with three mounting options

Typical applications:

- Tugs
- Offshore supply/service vessels
- Cargo vessels
- Workboats
- Icebreakers

Typical technical data	Ducted FP prop.	Ducted CP prop.	CRP
Propeller diameter (mm)	1050 - 4000	1600 - 3500	1250 - 2700
L, nominal stem length (mm)	1500 - 5000	2500 - 4790	1500 - 3305
Weight, dry (kg)*	1850 - 82000	11200 - 56000	1800 - 15000
Nominal input speed (rpm)	720 - 1800	720 - 1800	750 - 1800
Nominal input power (kW)	330 - 5000	1050 - 3700	330 - 1500
Bollard pull range (tonnes per two units)	9.5 - 170+	28 - 130+	-

*Max dry weight of weld-in installation. All data subject to change without prior notice.

Azimuthing contra-rotating propellers

The Rolls-Royce azimuthing contra-rotating propeller, type Contaz, is the world's first thruster system designed and built especially for merchant vessels. It combines the benefits of contra-rotating propellers with steerable thrusters. The latest bearing, gear and shaft technology are the keys to the Contaz – refined and developed through decades of experience.

The Contaz also represents a new way of designing and building ships, and to arrange its power and auxiliary systems for maximum economy, utilisation and comfort. Every unit is specifically designed and built for the particular ship it is going to serve.

The overall benefits are better outline arrangement, better propulsion efficiency, better fuel economy, better course keeping stability and reduced vibration and noise.

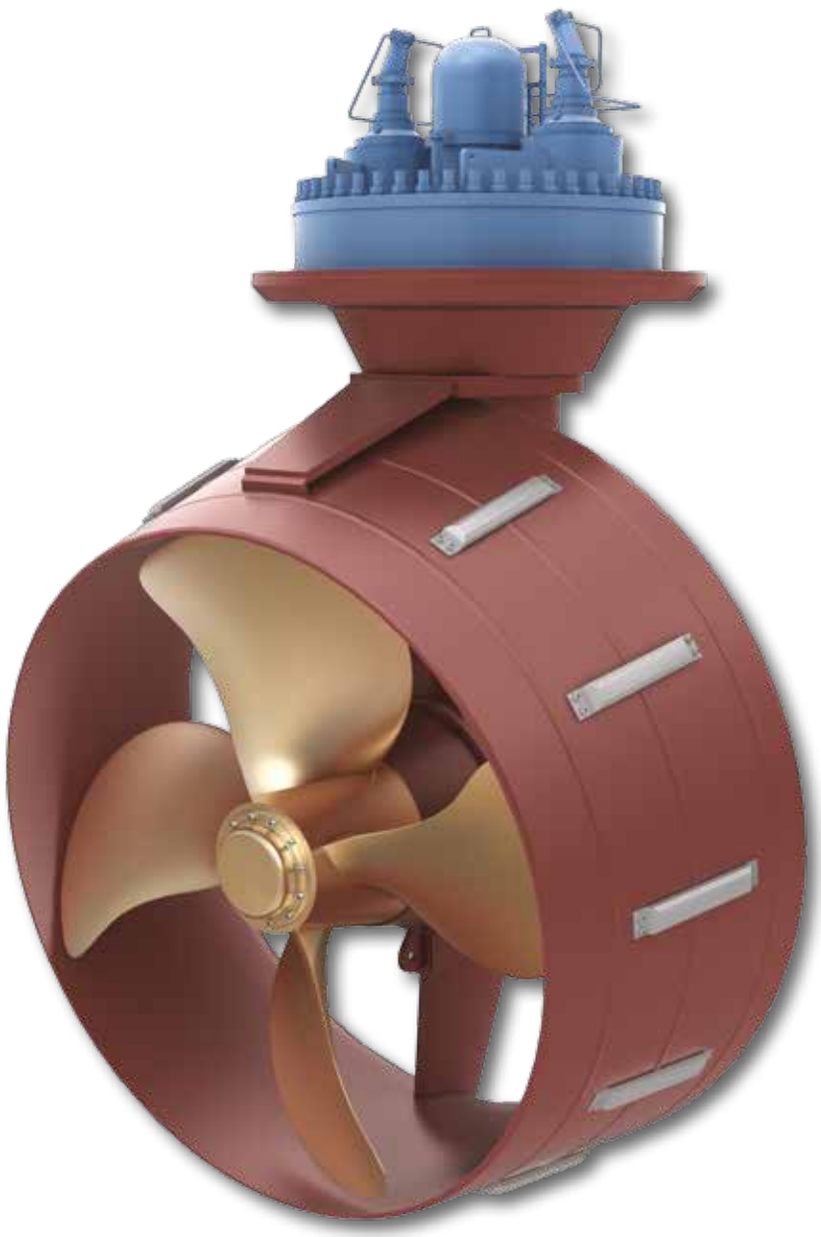
Technical data	Contaz 15	Contaz 25	Contaz 35
Maximum propeller diameter (mm)	3200	3700	4000
Stem length H (mm) Min.	4250	5000	5600
Max.	8500	9500	11000
Weight, dry (tonnes)	32	50	70
Nominal input speed (rpm)	900 - 1500	900 - 1500	750 - 1000
Power max. kW	2200	3000	3700

All data subject to change without prior notice.

Typical applications:

- Passenger/car ferries
- Offshore supply vessel
- Offshore service vessels
- Offshore stand-by vessels
- Coastal ferries
- Naval vessels

Azimuthing underwater mountable thrusters



The range of Rolls-Royce underwater mountable thrusters are designed for easy underwater mounting and dismantling without dry-docking the application. This is of utmost importance to large vessels and semi-submersible oil drilling rigs.

There are two alternative ways to connect the lifting wires: Connecting inside the ship to the thruster flange or externally to the lifting lugs on the thruster flange. The former is typical on the drill ships and the latter on the semi-submersibles. All necessary plugs, blinds and domes are supplied with the thruster for underwater (de)mounting.

USE is designed for installation in dry conditions. This type can be mounted directly to the hull or on a container. The container can be either of retrievable or retractable type.

USL is a compact design with bottom well and foundation for vertical drive motor. USL installation method means wet mounting from the top through a wet casing.

Size	305		355	405	455		505
Prop. Dia (m)	3.0	3.2	3.5	3.8	4.1	4.1	4.2
MCR (kW)	3200	3200	3800	4600	5000	5500	6500
Input (rpm)	720	720	720	720	720	750	600

The final data is subject to application and to be reconfirmed by Rolls-Royce.

Typical applications:

- Semi-submersible drilling rigs/ships
- Production vessels
- Other large vessels

Azimuthing swing-up thrusters

This thruster swings up into a housing in the hull when not in use. It can quickly be swung down about a horizontal axis into the operating position. In operation, it functions as an azimuth thruster and is designed to develop maximum bollard pull in the manoeuvring condition, or to provide positioning power for station keeping. The thruster has the added safety benefit of functioning as a 'get you home' drive. A high thrust is developed in relation to input power, and this thrust can be vectored in any desired direction.

In the stowed position the thruster does not protrude below the vessel's keel/baseline, an important consideration for shallow water operations. Additional azimuth thrusters are often located at the lowest possible position in the hull due to space envelope restrictions, especially for equipment mounted at the bow, and thrusters need to be retracted into the hull when not in use.

This thruster unit is used on both swing-up and combi version.

Typical applications:
- Tankers
- Cargo vessels
- Cruise ships/ferries
- Arctic vessels
- Drilling rigs
- Various types of naval support vessels

The swing-up principle
- Down position: functions as an azimuth thruster for positioning and 'get you home' drive
- Up position: stowed with no projection below keel line

Key product benefits
- Can be delivered as containerised unit
- Available in CP and FP propeller
- Electric or diesel drive
- Remote control system

Combined azimuth/side thrusters

The Rolls-Royce combined azimuth/side thruster is stored in the ship's hull by rotating the complete unit 90 degrees around the horizontal axis. In the retracted position, the thruster can be operated as a side force thruster. The upper part of the thruster is hinged, enabling the thruster to be lowered through an arc into its azimuthing position or retracted into a recess where it lies horizontally in the hull.

The Rolls-Royce thruster is designed as a nozzle propeller in lowered as well as retracted position. This means low noise and higher thrust compared with a traditional tunnel thruster.

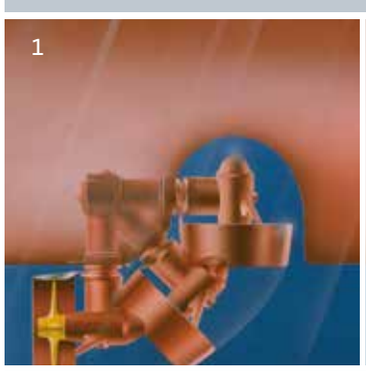
The combi thruster version is comprised of an equivalent standard swing-up unit installed in a specially designed hull module.

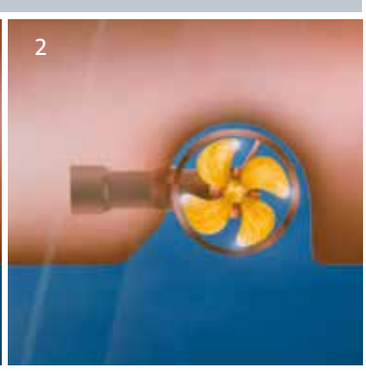
When in swing-up position (retracted) the steering gear may be rotated so that the propeller unit is used as a transverse thruster. Speed of response in terms of changing thrust direction is similar to conventional thrusters. The steering unit can be rotated through 180° in some ten seconds. The combi thruster is delivered with remote control system.

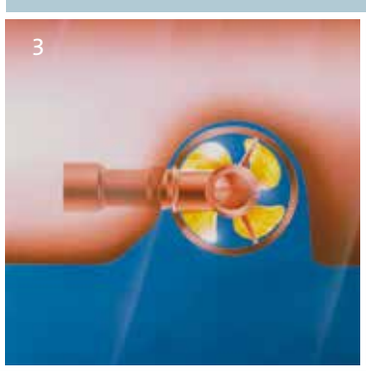
Two operation modes:
- 360° rotatable as azimuth
- Side thruster when retracted

Key product benefits
- Available in CP and FP propeller
- Electric or diesel drive
- 360° rotatable as azimuth
- Side thruster when retracted

Typical applications:
- Offshore supply/service vessels
- Offshore production vessels
- ROV/survey support ships
- Tugs
- Fishery research vessels
- Various naval support vessels







1. When lowered, the thruster functions as an azimuth thruster.

2- 3. When swung into the recess, it acts as a highly efficient tunnel/side thruster.

Unit type	Max power (kW)	Input speed (rpm)	Weight (kg)		Main dimensions (mm)
			Thruster w/ steering gear	+Hull module	Prop. dia.
TCNS/C 73/50 - 180	880	1800	9500	1000	1800
TCNS/C 92/62 - 220	2000*	1800	17000	17000	2200
TCNS 120/85 - 280**	3000	720 - 750	45000	50000	2800
TCNS/C 075	750 - 1000	1500 - 2000	16200	5100	1700
TCNS/C 100	1665 - 2000	1500 - 1800	29100	9700	2200

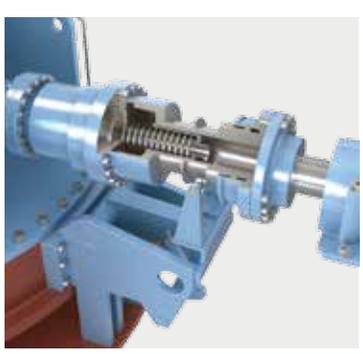
* For electric drive only, ** Delivery upon special request
All data subject to change without prior notice.

Retractable thrusters

The range of Rolls-Royce retractable thrusters has the same main components as our other azimuthing thrusters. The retractable thrusters provide fast hydraulic lifting and lowering of the unit. UL thruster type is designed for horizontal drive with automatic drive shaft disconnecting system and ULE type is designed for vertical drive.

The mounting is a 'bolt-in' top mounted type. The thruster is lowered into the hull casing, bolted to the casing counter flange and aligned. The lower end of the lifting cylinder and the top of the upper guide rails are connected firmly by brackets to the ship's construction.

Drive shaft arrangement
Standard drive shaft arrangement is a complete assembly with a solid shaft including bearings, a remote controlled clutch and a flexible coupling for prime mover.



Disconnection of the drive shaft before the thruster is lifted up.

Typical applications:

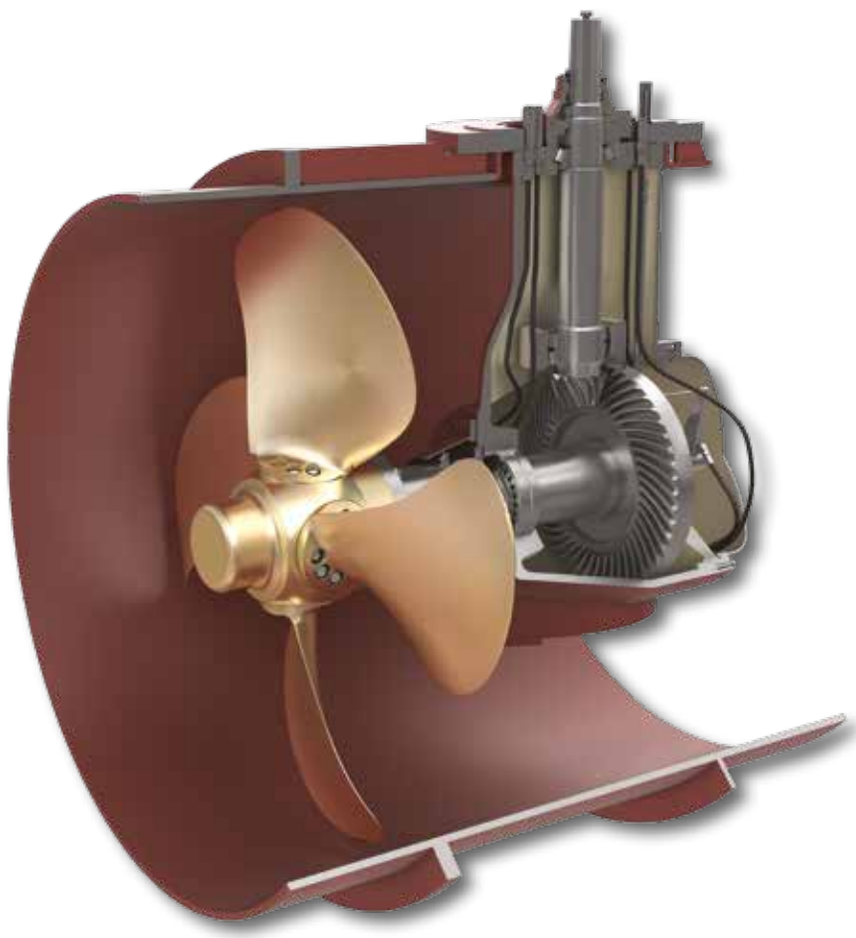
- Offshore service/supply vessels
- Offshore construction vessels
- ROV/survey support ships
- Tugs
- Fishery research vessels
- Shuttle tankers

Technical data UL	UL 601	UL 901	UL/ULE 1201	UL 1401	UL/ULE 2001	UL/ULE 255	UL/ULE 305	UL 355
Propeller diameter (mm)	1300	1600	1800	2000	2300	2800	3000/3200	3500
Propeller type	FP	FP	FP/CP	FP/CP	FP/CP	FP/CP	FP	FP
MCR (kW)	440	660	880	1200	1500	2200	3200	3700
Input speed alternatives (rpm)	1500 - 1800	1000 - 1800 ULE FP: 1000	750 - 1800 ULE: 720 - 750	750 - 1800	750 - 1800 ULE: 720 - 750	900 - 1800	750 - 1600 ULE: 720	720 - 1200
Dry weight, (kg) UL type	6000	12000	16500	24000	27500	47000	66000/68000	97000
Dry weight (kg) ULE type			21000		32000	43000	80000	

All data subject to change without prior notice.

Tunnel thrusters

The Rolls-Royce range of tunnel thrusters are fitted to a wide range of vessels operating in all corners of the world. The tunnel thruster is designed for giving maximum side force to the ship in manoeuvring condition. The system normally consists of the thruster unit with tunnel, hydraulic equipment, remote control and electrical drive motor with starter. Thrusters are available in both CP and FP versions.



Typical applications:

Suitable for, and installed in all types of vessels.

Key product benefits

- Skew blades
- Heavy duty propeller with double lip seal
- Mechanical locked bearings in DP thrusters
- Shaft seal pressure control with drain connection in DP thrusters
- Available in CP and FP type

Technical data, type TT-CP/FP

	Maximum power kW					
	El motor			Diesel		
D mm	Version AUX	Version ICE/DPN/DPD	Version DPN/DPD	Version AUX	Version ICE/DPN/DPD	DPN/DPD
1100	255 - 390	230 - 350	230 - 350	290 - 340	260 - 310	260 - 310
1300	390 - 595	350 - 535	350 - 535	435 - 520	390 - 475	390 - 475
1650	600 - 865	530 - 780	530 - 780	630 - 760	600 - 685	570 - 685
1850	620 - 1050	550 - 950	550 - 950	780 - 930	700 - 840	700 - 840
2000	830 - 1400	645 - 1200	730 - 1200	905 - 1040	1025 - 815	815 - 1025
2200	750 - 1510	645 - 1355	680 - 1355	1020 - 1325	980 - 1190	925 - 1190
2400	1100 - 1910	925 - 1660	980 - 1720	1320 - 1680	1250 - 1510	1180 - 1510
2650	1260 - 2400	1060 - 1900	1120 - 2160	1892 - 2110	2000 - 1700	1700 - 2000
2800	1630 - 2650	1450 - 2140	1450 - 2140	2090 - 2330	2096 - 1880	1880 - 2095
3000	1750 - 3000	1520 - 2700	1520 - 2700	2210 - 2640	1990 - 2370	1990 - 2370
3300	2100 - 3700	1850 - 3330	1850 - 3330	2730 - 3250	2450 - 2930	2450 - 2930

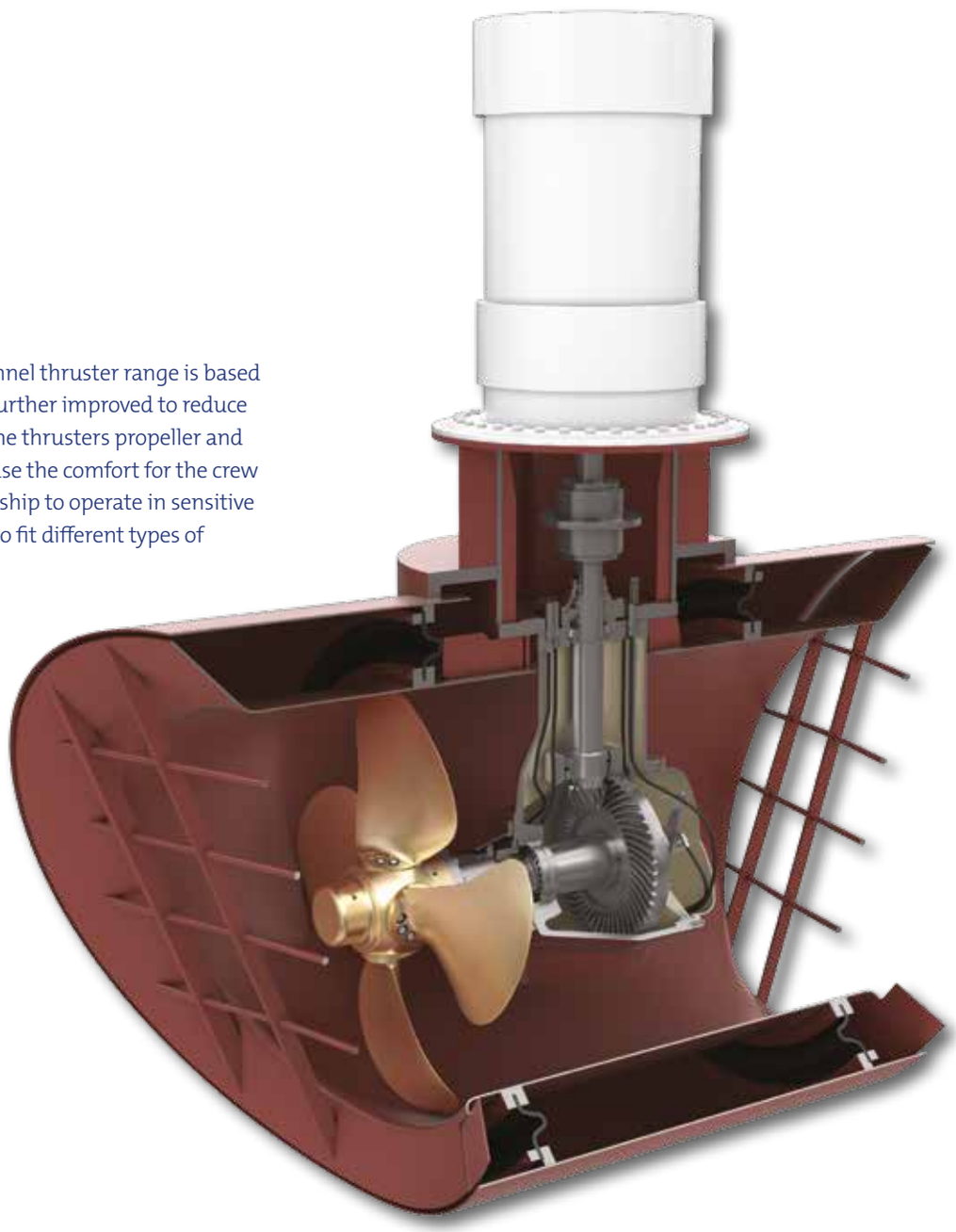
All data subject to change without prior notice.

Tunnel thrusters

Super Silent type

The Super Silent (SS) version of our tunnel thruster range is based on the standard tunnel thruster and further improved to reduce noise and vibration levels created by the thrusters propeller and surrounding structure. This will increase the comfort for the crew and passengers and further allow the ship to operate in sensitive areas. The system can be tailor-made to fit different types of offshore or merchant vessels.

The Super Silent tunnel thruster has double walls in the full tunnel length with a flexible mounted inner tunnel. The concept provides noise reduction up to 15 dB compared to standard designs. A reduction up to 25 dB can be reached in combination with floating floors and other measures by the shipbuilder.



Thruster type	Dia. mm	Motor rpm	Propeller output rpm	Max. power kW
TT1850 SS	1850	1180	289	800
TT2200 SS	2200	880	225	1200
TT2200 SS	2200	1190	242	1150
TT2400 SS	2400	1190	230	1500
TT2800 SS	2800	880	199	2140

All data subject to change without prior notice.

Typical applications:
Suitable for, and installed in all types of vessels.

Key product benefits

- Reduced tip speed
- Noise reduction of up to 10 dB compared to standard design
- Reduction of up to 25 dB can be reached in combination with floating floors and other measures by shipbuilder

Permanent magnet type

The Permanent magnet tunnel thruster (TT-PM) is the latest tunnel thruster design from Rolls-Royce and has been engineered with reliability and through-life costs as the focus. Using permanent magnet motor technology increases efficiency and makes the installation more compact, only the variable frequency drive unit is housed in the thruster room, freeing up space on board. It also simplifies maintenance as the patented mount means units can be removed and replaced without drydocking. These PM thrusters are currently available in two sizes with powers of 1000 and 1600 kW. These thrusters have been developed for the most demanding applications such as dynamic positioning (DP).

Due to its symmetric design the permanent magnet tunnel thruster provides increased flexibility for the ship designer to achieve a more optimal and space-saving installation.

Typical applications:

Suitable for, and installed in all types of vessels.

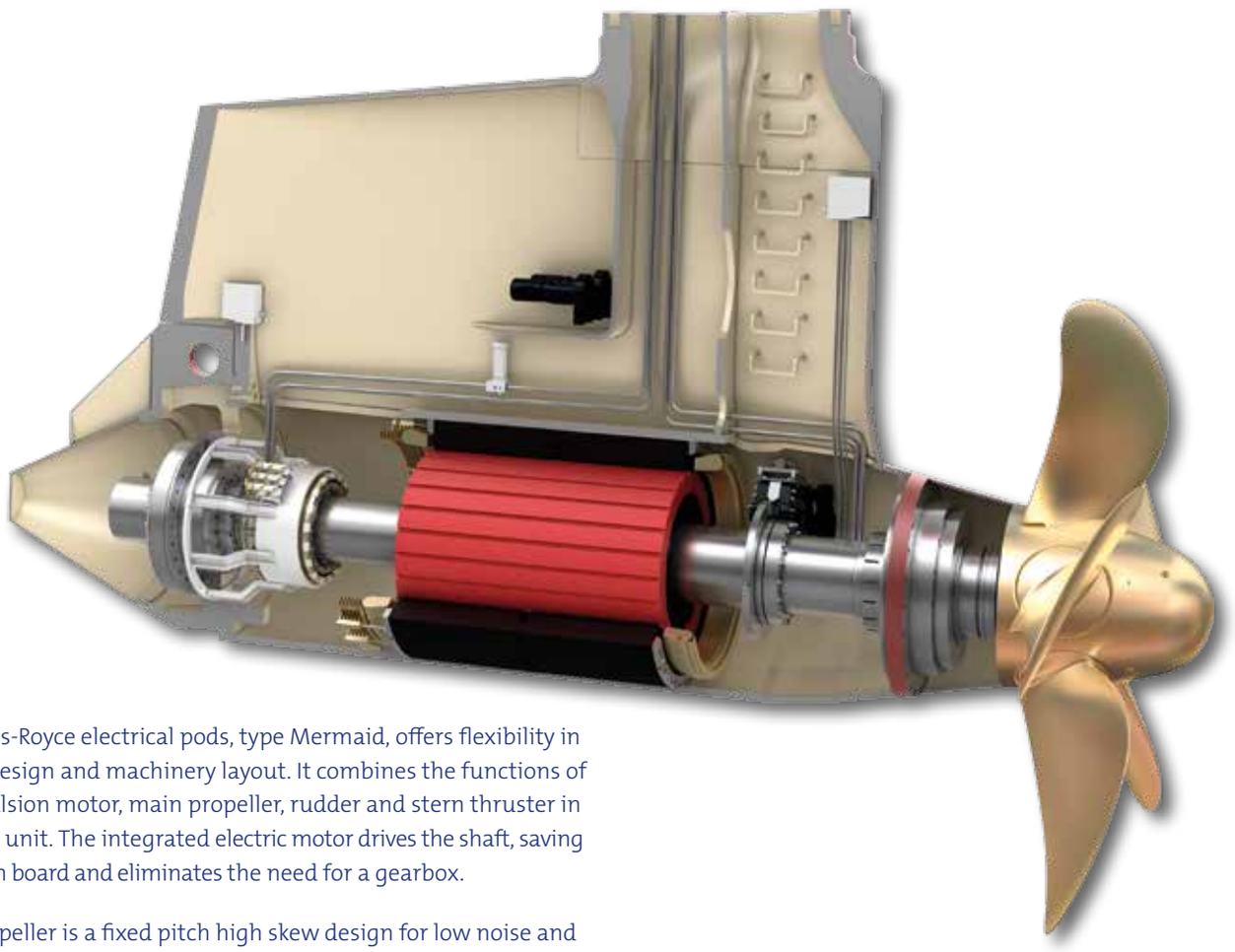
	Dim. mm			Weight kg		Performance			
Thruster type	**Prop. Dia.**	**Tunnel Dia.**	**Thruster Dia.**	**Connection & mounts**	**Total dry weight**	**Power MCR kW**	**Max. thrust kN**	**Prop. type**	**Hull mount**
TT PM 1600	1600	2180	7250	1957	11730	1000	146	Mono FP	8 x rubber bushings
TT PM 2000	2000	2600	12217	2540	18318	1600	229	Mono FP	8 x rubber bushings

All data subject to change without prior notice.

Key product benefits

- Rugged design with high reliability
- Equal thrust in both directions
- Patented resilient mounting system reduces noise and vibration
- Simplifies tunnel fabrication and removal/installation

Azimuthing electrical podded propulsors



The Rolls-Royce electrical pods, type Mermaid, offers flexibility in vessel design and machinery layout. It combines the functions of a propulsion motor, main propeller, rudder and stern thruster in a single unit. The integrated electric motor drives the shaft, saving space on board and eliminates the need for a gearbox.

The propeller is a fixed pitch high skew design for low noise and vibration. It can be supplied as a monobloc or with separately bolted blades, that can be simply changed in the event of damage. All pods are equipped with robust, environmentally friendly seal systems with no oil release to sea even in the event of a failure.

Key product benefits

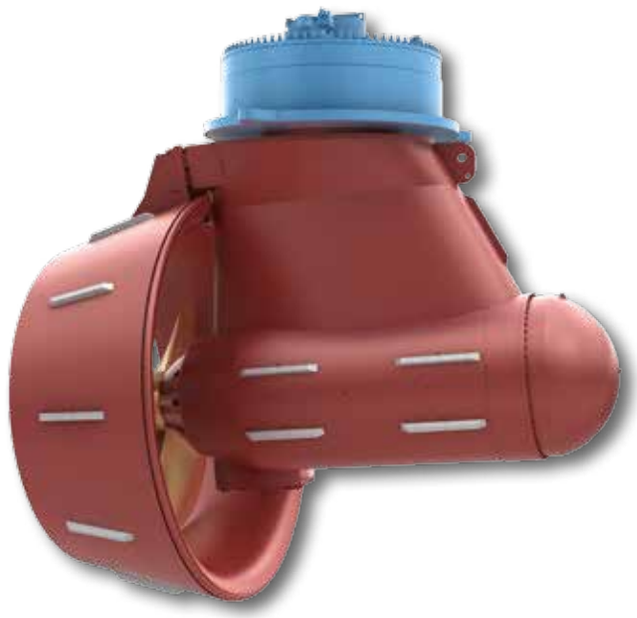
- Powers from 5 to 27 MW
- Synchronous motor with brushless excitation, or induction motor
- Excellent manoeuvring capability
- Flexible machinery arrangement with simpler machinery installation
- High efficiency with low noise and vibration
- Environmentally friendly sealing arrangement
- Remote controlled brake and locking unit
- Pulling azimuth unit for maximum propulsive efficiency

Standard pod	185	210	232	250	277
P_d (MW)	6 - 11	8 - 16	11 - 20	13 - 23	15 - 27
n_{shaft} (rpm)	110 -210	105 - 195	100 - 180	95 - 170	90 - 160
D_{prop}(m)	3.6 - 5.4	4.1- 5.9	4.5 - 6.5	4.9 - 7	5.4 - 8
Weight (t)	70 - 115	110 - 155	145 - 190	180 - 220	210 -270
Speed (kN)			Up to 24		

All data subject to change without prior notice.

Typical applications for all types:

- Offshore rigs
- Tankers
- Cruise ships
- Ro-Ro ferries
- Naval vessels
- Ice-going vessels



ICE and HICE type

The ice-strengthened pods are specifically designed for all vessels that operate in the toughest arctic conditions. The ICE units are designed to IACS PC4 and provide excellent hydrodynamic performance for open sea voyages for fuel savings in a mixed operating profile. HICE pods for heavy duty ice applications are designed for ice classes to IACS PC1. Both types are equipped with robust heavy duty induction PWM motors with high torque at low rpm suitable for tough ice milling conditions.

Key product benefits

- Power range 5 to 18 MW
- Induction PWM motor
- High torque at low shaft speed for good ice milling capability
- Stator shrink fitted to pod housing for efficient cooling
- Stainless steel fixed pitch propeller with bolted blades for simple change out

ICE and HICE size	185	210	232	250	277
P_d - Bollard pull (MW)	4 -7	6 - 11	8 - 13	10 - 15	12 - 18
$n_{shaft\ BP}$ (rpm)	110 - 170	110 -156	105 - 147	100 - 140	95 - 132
D_{prop} (m)	3.2 - 4.5	3.7 - 5	4.3 - 5.65	4.7 - 6.0	5.2 - 6.6
Bollard pull thrust (kN)	450 - 850	550 - 1200	950 - 1500	1550 -1650	1300 - 2050
Weight (t)	80 - 145	125 - 185	160 - 230	200 - 290	250 - 350
Open water speed (kN)	Up to 20				

All data subject to change without prior notice.

PUSH type

The pushing pods are designed for low speed, high load and high bollard pull applications. Fitted with a hydrodynamically optimised nozzle for maximum efficiency, they enable offshore operators to utilise the full benefits of space saving electrical pod propulsion.

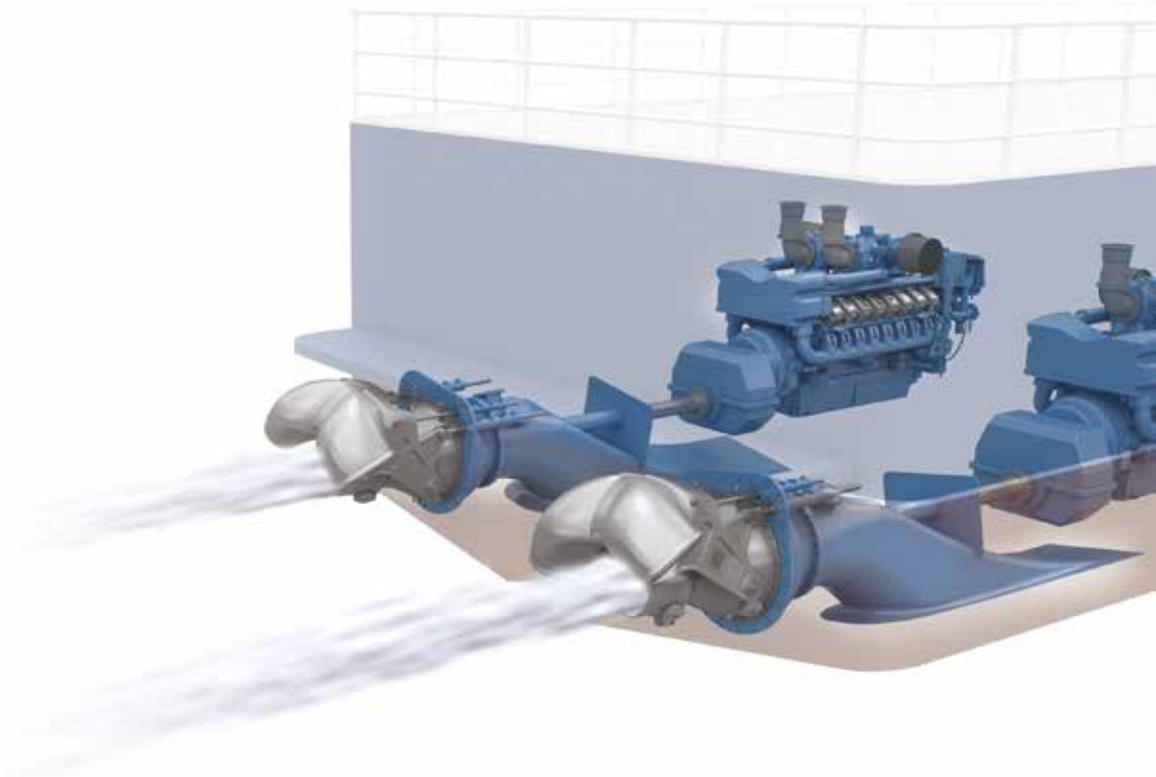
Key product benefits

- Power range 4 to 11 MW
- Induction or Synchronous motor
- Excellent performance for applications requiring high thrust and reliability
- Underwater mountable option for most hull designs
- Choice of fixed pitch monobloc or bolted propeller

PUSH size	185	210
P_d Bollard pull (MW)	4 - 8	7 - 12
$N_{shaft\ BP}$ (rpm)	110 - 190	105 - 160
D_{prop} (m)	2.7 - 4.5	3.6 - 5.2
Bollard pull thrust (kN)	550 - 1250	950 - 1750
Weight (t)	60 - 120	110 - 160
Open water speed (kN)	Up to 16	

All data subject to change without prior notice.

Waterjets

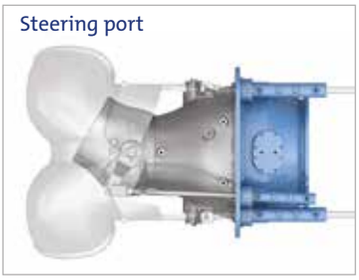


Forward propulsion

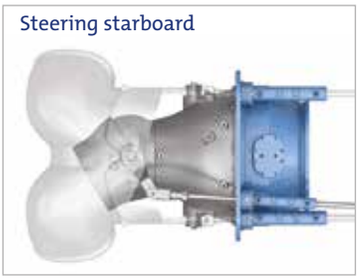
Zero speed

Reversing

Steering port



Steering starboard



Steering and manoeuvring forces are obtained by moving the bucket up and down and the nozzle from side to side.

Superior performance and manoeuvrability

The waterjet has many advantages over a propeller. The very high efficiency of the Kamewa waterjet pumps offer higher speeds for the same power or substantially lower fuel consumption at a constant speed with less power.

Waterjets also give the engine an easier life. At constant rpm the waterjets absorb approximately the same power regardless of the vessel's speed, so the engine can not be overlaoded, meaning fewer breakdowns and a long lifetime.

Typically waterjets produce less vibration and noise, improving passenger comfort levels. At speeds over 20 knots vibration and noise can be reduced by more than 50%.

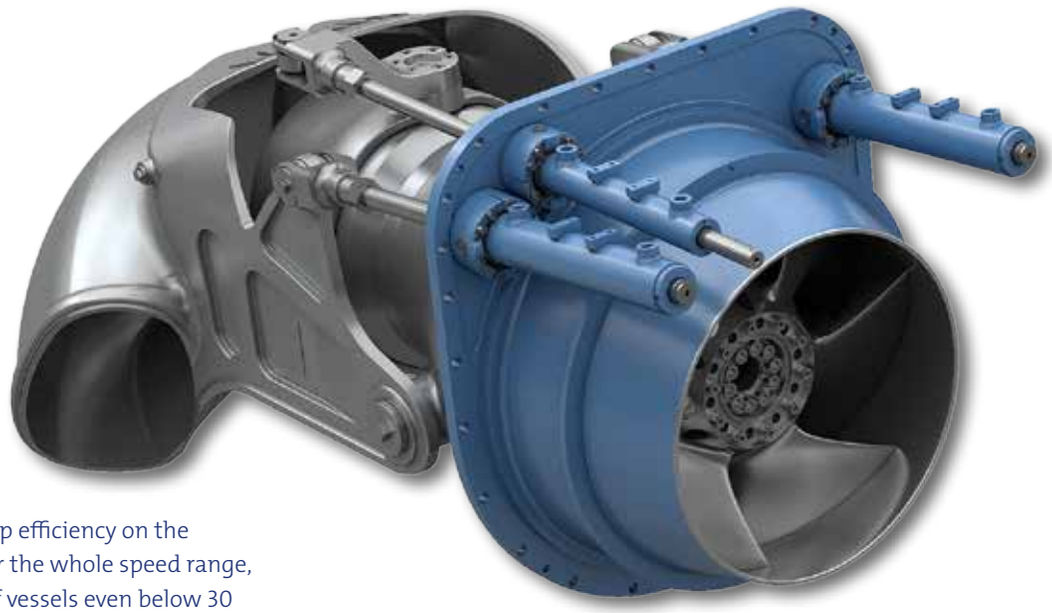
With two or more waterjets and Rolls-Royce control systems manoeuvrability is excellent, allowing vessels to be berthed quickly and with high precision.

Kamewa waterjets are designed for ease of installation in hulls made of different materials, reducing vessel build time and simplifying shipyard logistics. They can be supplied with steering and reversing buckets or as booster units providing forward thrust only.

Different impeller blade pitch angles are available for fine adjustment of the rpm for optimum performance.

The impeller's task is to pressurise the water. The reaction force that is created when the water leaves the pump is utilised to propel the ship.

Waterjets



Steel series

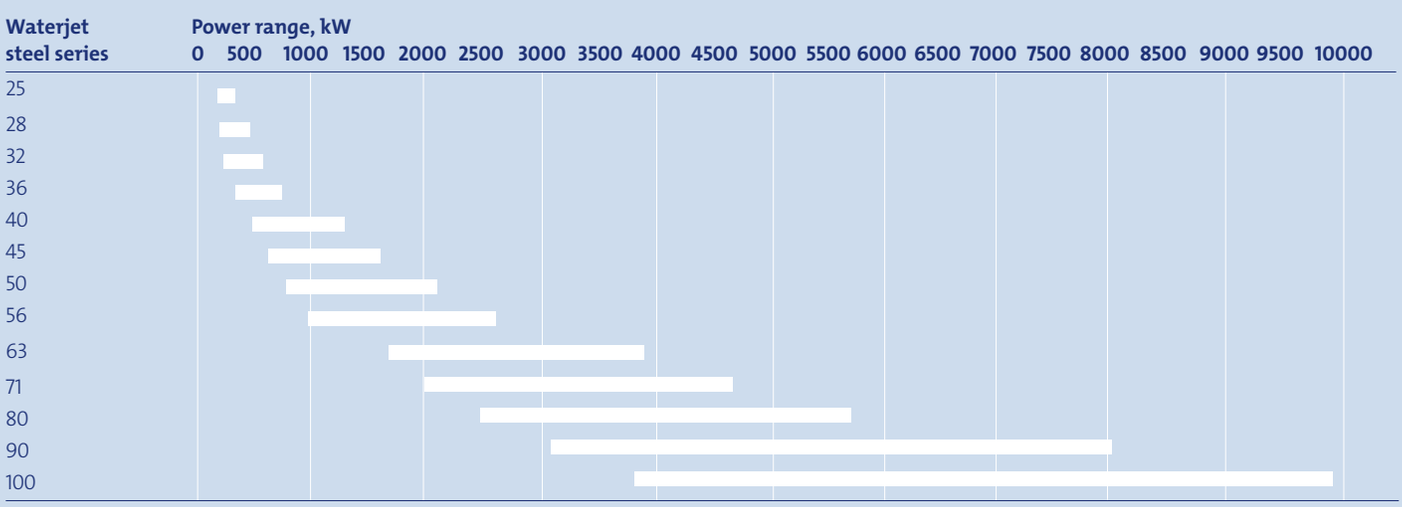
Our steel waterjets have the best pump efficiency on the market. The efficiency is improved over the whole speed range, and matches the increased demand of vessels even below 30 knots. This translates into reduced fuel consumption for a given workload and consequently reduced CO_2 emissions, as well as increased range. Environmental benefits are achieved by increasing efficiency and the use of inboard hydraulics also reduces the risk of oil spills.

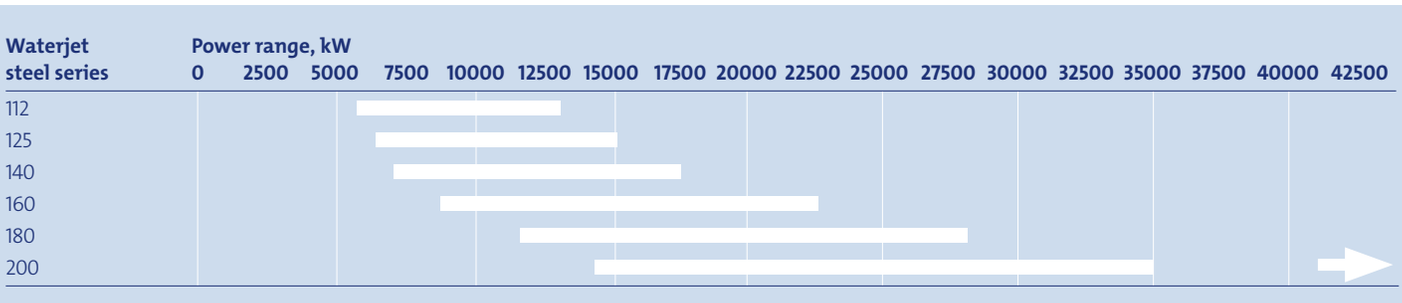
The steel series incorporates numerous improvements made possible by advanced design calculation methods and testing and production techniques. The compact reversing bucket and steering nozzle enables superior position keeping and manoeuvrability at low and high speed. This helps to reduce fuel consumption. It also cuts noise and emissions in harbour manoeuvring and saves time, as well as improving safety. In high speed turns, the jets maintains speed with high efficiency – a highly valued benefit for patrol vessels and others vessels.

Typical applications:

Larger waterjets – high speed vessels such as:

- Large passenger/vehicle ferries
- Naval vessels
- Coastguard vessels
- Superyachts





Close attention has been paid to extending service life. Maintenance is intended to be easy and needed only infrequently, with a time between overhauls involving replacement of parts subject to wear up to 15,000 running hours or five years. As an option larger waterjet shaft seals can be replaced with the vessel afloat using the inflatable seal provided.

Steel series waterjets are delivered with a new touch-screen compact control system. Among its features are 'stay on the spot' automatic manoeuvring which controls the jets to keep the vessel at a desired point, and an interface to link to a dynamic positioning system. The touch-screen provides a clear picture of system status, allowing conditioning-based maintenance planning and also training. Skid version waterjets can also be supplied with factory-mounted and pre-calibrated control box.

Steel series – Modular installation

Steel series waterjets are designed to be easy to install in hulls constructed from different materials. The owner or yard can choose from three delivery concepts, each of which can also have a choice of three different materials for the inlet duct.

Rolls-Royce recognises that shipyards have their individual preferences for the way in which a waterjet is integrated into the vessel, the installation sequence, and whether the inlet duct is supplied or built by the yard to drawings.

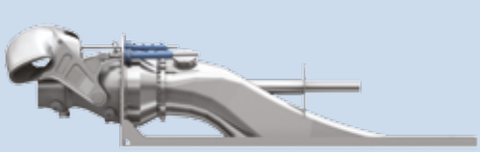
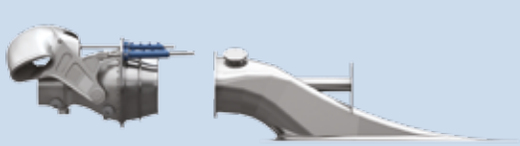
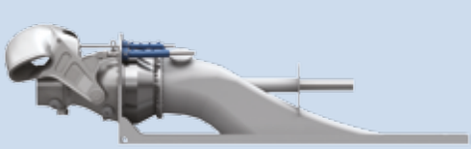
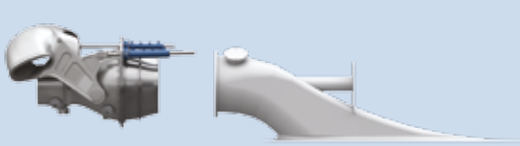
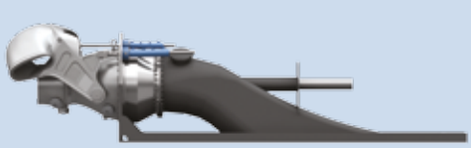
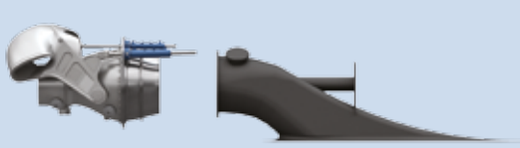
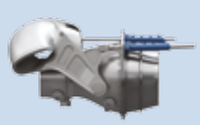
The delivery programme is divided into three ways of supplying steel series waterjets. The first is that the yard receives a waterjet as a complete skid mounted unit with pump and inlet together and the bucket/nozzle controls assembled. The second option is that the inlet and controls are supplied as a skid mount ready for installation, the pump being supplied as a separate unit to be bolted in place at a later stage of construction of the vessel. The third option appeals to shipyards that prefer to fabricate their own inlet ducts as part of the hull construction. In this case Rolls-Royce supplies the pump/reversing system as a unit, and provides the drawings for the optimum inlet for the yard to work from.

Irrespective of which of these options is chosen, the inlet can be made of steel, aluminium or composite (GRP) to suit the material chosen for the hull. In all cases the pump which forms the outboard unit will be in stainless steel.

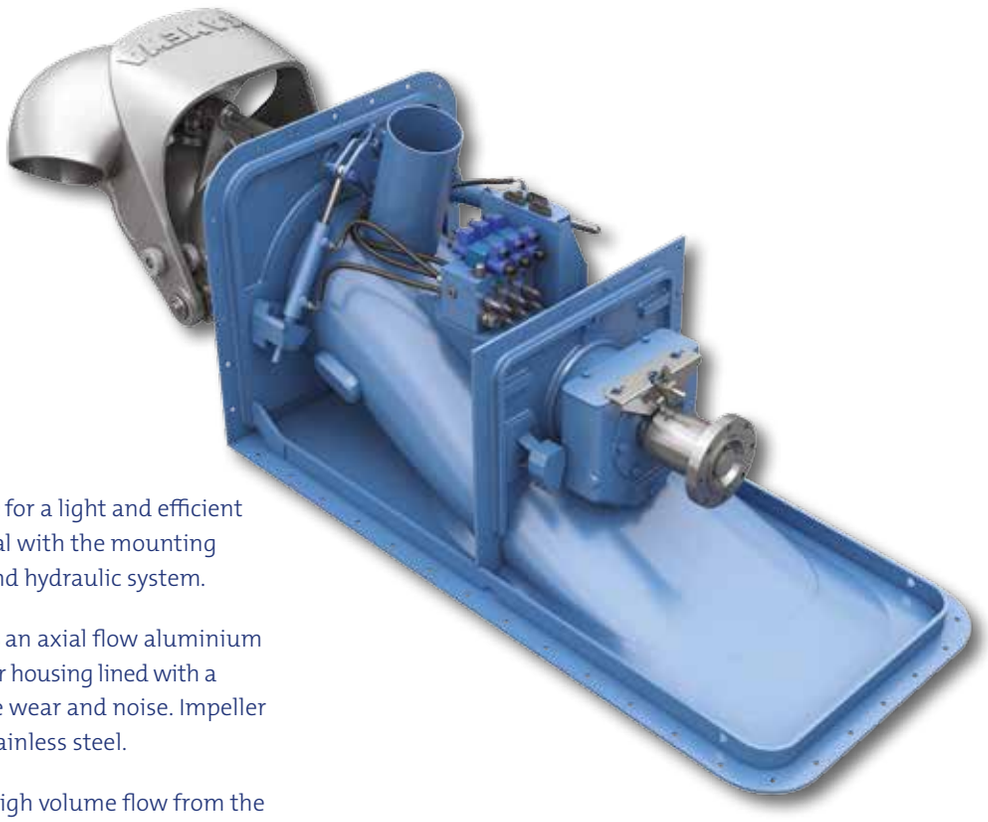
Delivery programme

The diagram shows the nine ways in which a steel series waterjet can be supplied, with a choice of three materials for the inlet duct and three ways of delivering the waterjet to suit yard or owner preferences.

Delivery program – Steel series

	Complete skid mounted delivery	Delivered as separate units	Jet + inlet drawing
Steel inlet			
Aluminium inlet			
Composite inlet			

The final data is subject to application and to be confirmed by Rolls-Royce.



Aluminium series

Major components in aluminium make for a light and efficient waterjet. The aluminium inlet is integral with the mounting flange and carries the thrust bearing and hydraulic system.

The pump section is outboard and uses an axial flow aluminium pump. The interior surface of the impeller housing lined with a special rubber-like material to minimise wear and noise. Impeller shaft and reversing rods are made of stainless steel.

Aluminium series waterjets provide a high volume flow from the axial pump, with a good driving thrust at lower speeds making them suitable for both planing and displacement craft. They can be installed as single, twin, triple or quadruple systems to suit the vessel design, with steering/reversing or as boosters.

Impellers can be made to match optimally engine and gearbox range available for optimal performance.

Aluminium waterjets are normally supplied as skid-mount self-contained units ready for rapid installation, but tailor-made inlets can be provided to meet particular requirements, for example specialist naval craft.

Complementing the waterjets, modular interceptor trim tabs are available which bolt directly to the waterjet and help control boat trim and ride.

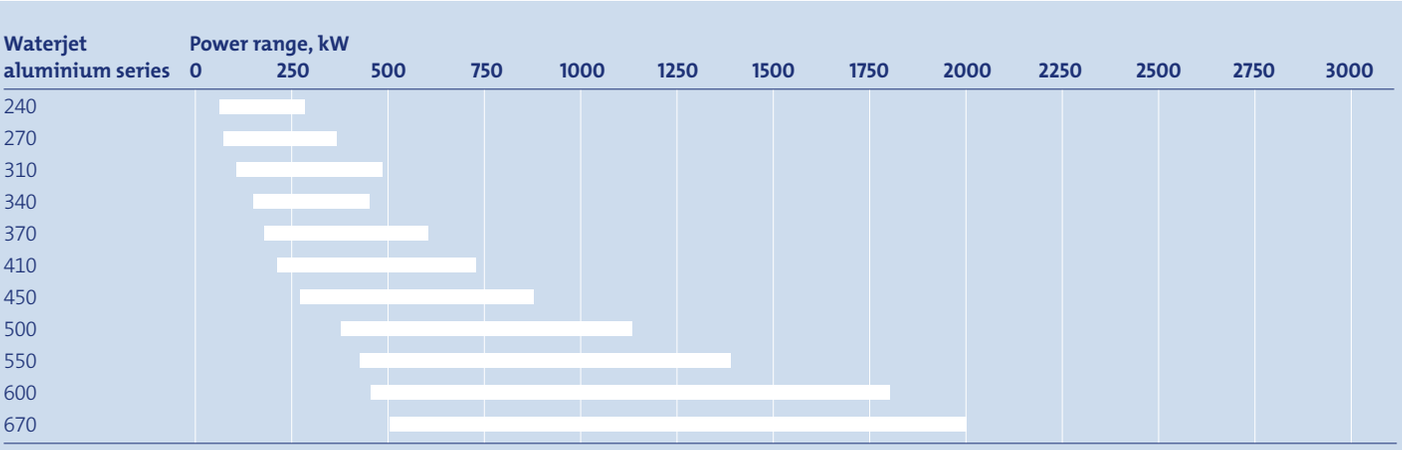
All waterjets are supplied with a control system ideal for smaller fast boats whose operator interface can be console or chair mounted to suit the customer's preference.

Typical applications:

Smaller waterjets - high speed vessels such as:

- Smaller passenger ferries
- Rescue crafts
- Smaller naval crafts
- Wind farm support vessels

Axial flow impellers can be made to match engine rpm for optimal performance.



Global service and support

Our support teams, located worldwide, are committed to helping you manage the vital balance between operational availability and cost. Wherever your vessel is located, Rolls-Royce support is close at hand.

Operational availability must be maintained today in the most cost-effective way. Variable market conditions and increasing competition should not undermine safe ship operations. Therefore, we work closely with our customers to support their fleets, ensuring that they are operating safely and at maximum efficiency, with the goal of virtually eliminating unscheduled downtime.

A comprehensive menu of service solutions

We are proud of the performance of our systems, and are keen to ensure that they continue to operate at their peak throughout their lifetime. Our services now range from conventional product support, with no impact on ship availability, through to a range of equipment and system support packages with levels of vessel performance and availability agreed, normally within a long-term risk and reward-sharing partnership called MarineCare.

Single point of contact

As we have progressively increased the breadth of our product range, we have continued investing heavily in the facilities and the talent needed to support them. As multiproduct installations are becoming standard on a growing number of vessels, customers benefit from a single point of contact for support, which is usually the nearest Rolls-Royce regional centre to the vessel's location.

Reducing through life costs

Reducing operating costs and maximising availability is our objective. This has led us to work closer with a number of our customers in maintenance planning and recommending spares holding. By being involved from the start we have the opportunity to focus on the activities that make a difference, acquiring and pre-positioning service or exchange parts to ensure a smoother overhaul process, saving time spent in dock.

Committed to meeting different needs

Above all, at the centre of our support philosophy, is recognition that all customers have different and often unique requirements, based on their fleet operations. Whatever the mix of requirements, Rolls-Royce is committed to meeting or exceeding them.

Product training

At Rolls-Royce we believe that regular training ensures that you will get the most out of a vessel's equipment and systems, and it also ensures that they are operated and maintained efficiently and safely.
Experienced and informed people are a key asset.
As technology advances, so must the competence levels of operators and service personnel. We therefore offer a range of tailored training courses and programmes in state-of-the-art facilities equipped with the latest simulators and training aids.

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